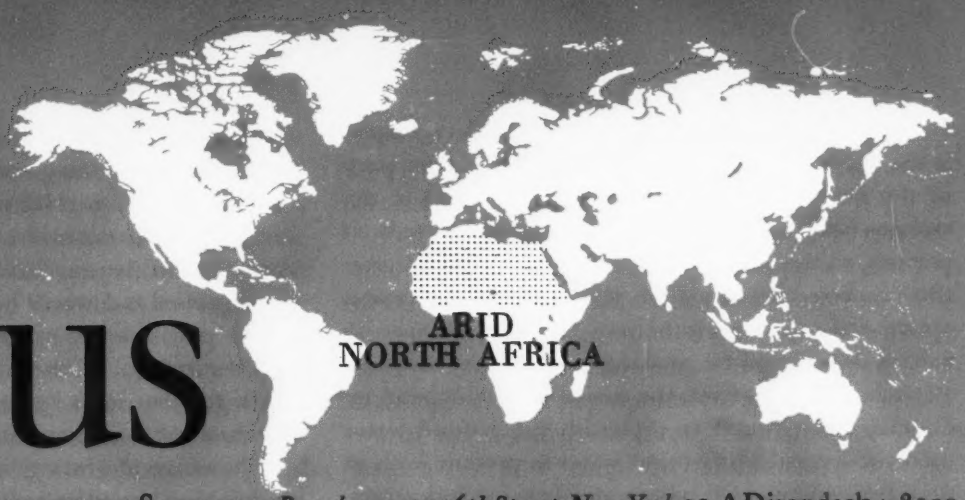

focus

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ALICE TAYLOR, EDITOR

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Outlook for Arid North Africa: The Sahara

The Sahara, tawny from dust, dusty from dryness, is the vastest desert in the world, stretching across the widest part of Africa from the Atlantic to the Red Sea. The continental United States could be spread out in the Sahara and still leave enough desert around the edges to make an Alaska.

Most of the Sahara gets an average yearly rainfall of less than one inch, which means anywhere from none to 5 inches in a given year. The core of extreme dryness grades off into less dry lands to the north and south, which in turn merge into the still moister steppes of the Mediterranean and Sudan borders.

Throughout history the rich, populous borderlands have profoundly affected the life of the Sahara. The Mediterranean margin, known to the Arabs as the Maghreb or Barbary, is a land of cool-season rains, winter wheat and barley, sheep, Berbers, Arabs, and European colonization. The Sudan is a land of summer rain, millet, cattle, and Negro farmers. Across the forbidding desert barrier these two worlds have been linked since time immemorial by precarious caravans, replaced only recently and in part by automobiles and airplanes.

The western and eastern borders also are favored by more moisture. Winds from the Atlantic bring damp clouds and even a little rain as much as 200 miles inland, benefiting vegetation and, consequently, the nomads. On the east, the Nile carries its equatorial waters completely across the desert, creating the world's greatest oasis.

Most of the Sahara is a patchwork of dry plains and plateaus, dotted with a few mountains (notably the Ahaggar and Tibesti) and numerous long, low cuestas. Most feared of all the plains is the Tanezrouft, "land of thirst," over which a camel can walk day after day in the glaring heat without finding a drop of water or a vestige of pasture. Since there are no natural landmarks, and previous tracks are quickly obliterated by wind and sand, travelers must depend upon stars, sun, and compass for guidance. Careless navigation may bring disaster.

The flat, wind-worked sand and gravel surface (called *reg* by the Arabs) characteristic of the Tanezrouft is widespread in the Sahara. There is usually plenty of sand between the stones, and movement is easy for animal or automobile. Travel is much more arduous in the *hammada*, where bedrock is exposed, swept clear of loose mantle, and in the *erg*, where wind has piled the sand into steep-sided dunes over vast areas.

Bare, rocky, impervious slopes are highly important to desert man, for they serve to concentrate the meager rainfall. Instead of evaporating in place, the water soaks the ground at the base of the slope enough

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to support considerable vegetation. Such vegetation is the only forage available for livestock in some parts of the desert. Runoff also converts the beds of dry streams (*wadies* or *oueds)* into roaring rivers for brief periods, so that crops can be raised in the mud after the water recedes. In some places the runoff creates ephemeral salt lakes (*sebkhas*). Only in the Spanish Sahara does runoff originating in the desert occasionally reach the sea. Even the oasis dwellers depend indirectly upon runoff to replenish the ground water used for irrigation. Ground water is present both in wadi beds and in deep-lying water-bearing rock strata.

The people of the Sahara are as unevenly distributed as the water. About 23 million live in the 13,000-square-mile Nile oasis, from Khartoum to Alexandria. In the Djerid oases there are 2,500 people per square mile; in the desert west of Egypt, only about one per square mile. Hundreds of thousands of square miles are entirely uninhabited.

The first recorded people of the Sahara appear to have been Negroes. Blacks, known as Haratin in the French Sahara, still form a majority of the population in many oases—descendents of ancient inhabitants and of slaves imported later. The introduction of the camel (strictly speaking, the one-humped dromedary) shortly before the time of Christ led to a shift in power. On their swift riding camels (*meharis*), Berber tribes swept across the Sahara to the borders of the Sudan, establishing control over the blacks. After the death of Mohammed the Berbers in turn began to be crowded out by another camel-riding group, the Arabs, fanatic bearers of a militant faith who made of Islam a culturally unifying element for the entire Sahara. Arabic is the leading language, though Berber tongues persist in the central Sahara and other scattered localities. The Arabs also introduced slavery. Right up to the twentieth century, when the French put an end to it, the most profitable business of the Sahara consisted in capturing black villagers in the Sudan, marching them across the desert, and selling the survivors in the slave markets of the Maghreb.

Two distinct ways of life characterize the Sahara: pastoral nomadism, and oasis agriculture. The nomads outnumber the oasis dwellers in the Sahara margins and the mountains, where rainfall and forage are best; the oasis dwellers predominate out in the desert, where life is dependent on ground water.

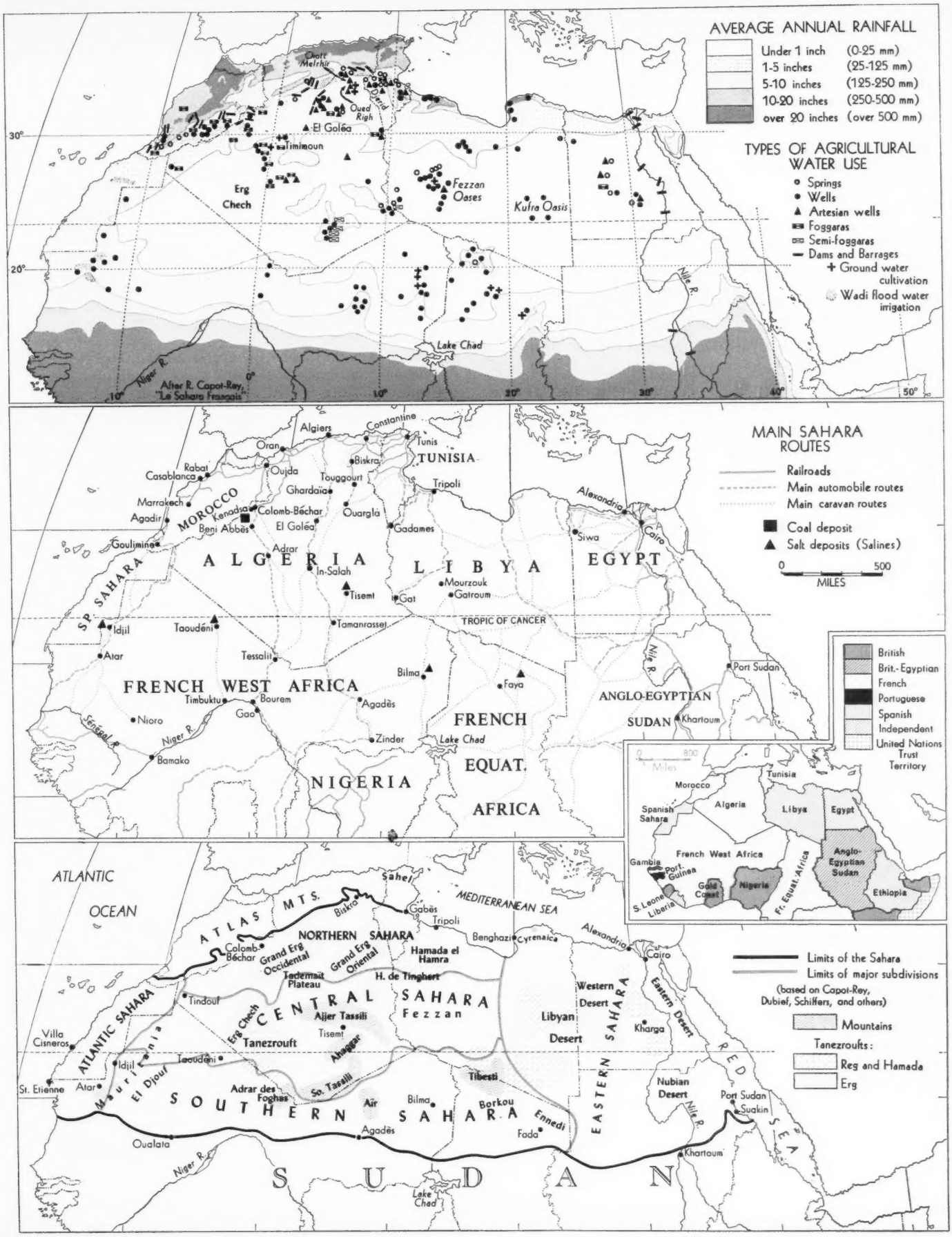
The Berber and Arab nomads are raisers of sheep, goats, and camels, and eaters of milk and cheese, with grain and dates when obtainable. In the moister margins, where seasonal forage can be counted upon every year, they migrate periodically with their sheep and goats over established routes. Farther out in the desert the fickle rains bring sporadic growth of short-lived grasses and weeds (*acheb*); long rapid treks between pastures are necessary. Mobility is the rule, and the symbol of the nomad is the camel and the black goat-hair tent (goat hide among the Tuaregs), which is low, wind- and sun-resistant, and roomy.

The range of grazing is limited by the availability of drinking water as well as of pastures. With juicy acheb, camels can go indefinitely without drinking in winter, but sheep need water at least every fourth day. In summer, sheep must drink every other day, camels every three or four days. Forage more than 15 miles from water is out of reach of sheep, but the camel tribes can range far. An outstanding example is a Regibat tribe, near the border of the Spanish Sahara, that sometimes migrates in pursuit of rains as far as the Erg Chech, more than 400 miles away.

Until the early 1900's, when the French succeeded in pacifying the area and put an end to robbery as a source of substantial profit, the nomads used their meharis for plundering raids (*razzias*) on the oasis towns, as well as for peaceful pursuits. Most nomadic tribes still derive income from oases, usually as owners of palm groves. Traditionally, except in Egypt, the humble black oasis inhabitants have been the slaves, serfs, or, now, share-croppers of the camel-riding lords, who are always on hand at harvest time to get their lion's share of the crop.

All but the purest of nomads raise some food themselves, but not through any great amount of menial labor. These semi-nomads plant grain in the mud when wadi floodwaters recede, or in natural undrained basins (*graras*) into which the wadies empty. The grain is then left untended until harvest time, and if grazing animals, grasshoppers, and desiccating winds have spared the crop, a substantial harvest may be reaped.

The nomads have always obtained considerable income from hiring out their camels or trading on their own account. Trans-Saharan caravans of gold and slaves formerly brought large profits to the Tuaregs, who controlled the central routes and the Regibats and Moors, who controlled the western route. Salt, much in demand in the tropical Sudan and southern Sahara, continues to be transported by caravans over long distances. More than 14,000 tons were



Maps drawn by Vincent Kotschar

produced in the Sahara in 1950—over 100,000 camel-loads. The trade is handled by *azalaïs,* or tremendous caravans (sometimes consisting of as many as 25,000 camels), that visit the salt mines in the spring and fall. From Timbuktu, for instance, the azalaï to Taoudéni carries feed to last the camels for the 2- to 3-week trip, and rice, millet, dried meat, and tea to exchange for salt.

Camel traffic remains vitally important for nomad and oasis trade, and places such as Goulimine, Ghardaïa, Biskra, Atar, and Agadès are busy distributing centers for the caravans of the desert margin. However, modern means of transportation are now competing for the long haul. Trans-Saharan passengers use airplanes or automobiles. An excellent network of air routes and limited automobile routes serve the Sahara. Regular though infrequent buses cross the desert on two roads, and trucks on four roads, all of which consist chiefly of the natural desert floor. The bus crossing requires six days by way of the Tanezrouft, compared with the four months taken by caravans. Some paved roads have been built by the French and the Italians in the north. A Colomb-Béchar—Gao railroad by way of the Tanezrouft has been surveyed and planned, but construction stopped 60 miles south of Colomb-Béchar, not because of engineering problems, but because of the expense of construction and the uncertainty of returns.

The Nile, the most ancient trans-Saharan track, is still navigated, paralleled by a railroad. Trade of the Anglo-Egyptian Sudan is funneled by rail to Port Sudan, on the Red Sea. Except for Alexandria, the outlet of Egypt, and Tripoli, which inherited the terminus of the old caravan route from the Sudan via Fezzan, Saharan ports are small trading and fishing bases of only local importance.

The oasis is a different world from that of the grazing, trading nomad. In the north, the compact *ksar* villages consist of adobe houses, often several stories high, with flat roofs for sleeping, and narrow covered streets for shade. Southern houses are conical and thatched. Basically the livelihood of the ksar is derived from date palms, introduced in Roman times. The groves are carefully pollinated in the spring, irrigated continuously, and harvested in late August and September (in the north). The first fresh fruit is eagerly eaten on the spot by the famished villagers, but the main crop is dried for later consumption or sale. Lesser crops include grains and vegetables suited to hot summers or Mediterranean winters, according to locality. In the steppe uplands of northern Libya and eastern Tunisia olive groves flourish, and Libya has a surplus of olive oil for export.

Varied and ingenious are the methods of obtaining water in the oases. Aside from the Nile and its barrages, and a storage dam in the mountains back of Biskra, permanent irrigation depends upon ground water, which may percolate great distances through porous sands or rocks. The most fortunate oasis dwellers have natural springs, some of them very large, where ground water issues unaided.

Next best are the man-made ones: *foggaras* and artesian wells. Foggaras are tunnels one to six miles long and big enough for a man to walk through, dug not quite horizontally to tap underground water and conduct it to the oasis by gravity. Water flow from foggaras is modest but dependable and automatic. The main foggaras today radiate around the escarpments of the Tademaït Plateau. Because cheap slave labor is no longer available, foggaras are no longer dug, and in some areas, such as the Fezzan, they have fallen into disuse.

Few artesian wells were dug until the development of modern machine boring. They have been exploited spectacularly in the Oued Righ, an ancient, half-buried wadi southwest of Chott Melrhir. When boring was begun in 1856, Oued Righ had about 300 wells and springs, with a total flow of 13,250 gallons per minute irrigating 360,000 palms. By 1924, there

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were 1,033 wells and springs, supplying 69,000 gallons per minute and supporting 1,610,000 palms. The boom lasted until the inevitable overdraft of water reduced flow and lowered the water table. Some power pumps were installed to supplement natural flow, but there simply was not enough natural replenishment to provide adequate water for all the planted groves. By using available water at maximum efficiency, a balance may have been reached by now, though at a level below the optimum for date production. Artesian areas at El Goléa and the Djerid are being developed systematically and successfully.

Ordinary dug wells, from which the water has to be raised by means of a bucket at the end of a rope, are the commonest source of irrigation water in the Sahara. Two types of mechanical aid are widely used: sweeps and pulleys. With a well sweep or balance, human operators raise the water. This system requires the least capital investment and is used by the poorest small proprietors. The pulley system uses horizontal traction and animal power. The maximum water flow obtainable by this method is about 15 to 25 gallons per minute, and then only if the water is near the surface. Mechanical power pumps have been little used, partly because electricity and gasoline are scarce and expensive in the desert.

Where ground water lies near the surface, pits, up to 45 feet deep, may be dug to permit the roots of plants to reach the moist ground without irrigation. This *bour* system of sunken gardens is well developed along the north edge of the Grand Erg Oriental and the south edge of the Grand Erg Occidental.

Share cropping is the prevailing system of land tenure. The standard share of the cropper is one-fifth of the harvest—he is called *khammès,* meaning fifth—though in some oases he receives a somewhat larger proportion. The landowner, whether nomad, merchant, Marabout, or corporation, provides tools, seed, water supply, and fertilizer. The khammès earns hardly enough to keep body and soul together, and during the past 20 years many have emigrated to the cities of the Maghreb, to the dismay of the landowners, who are now attempting, in a rather desultory manner, to improve the lot of the khammès by developing new water supplies, increasing the efficiency of water use, and lining irrigation canals to reduce loss by percolation.

Highly pertinent to the outlook for the Sahara is the question of rainfall: is it decreasing, as some believe? Probably there has been no significant change in the northern Sahara since Roman times. Apparent desiccation can be traced to human rather than climatic causes, particularly overuse of the native vegetation, overdraft of ground water, and past razzias. Springs seem to be flowing as well as in Roman days, and Roman rock cisterns of the northern littoral, unused for centuries, have recently been cleared and used again to gather runoff. There is widespread

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